MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2017/2018 SESSION

PTG 0116 – TRIGONOMETRY AND COORDINATE GEOMETRY

(All sections / Groups)

14 OCTOBER 2017
9.00 a.m. – 11.00 a.m.
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This question paper consists of 3 pages with 4 questions and an appendix.
2. Answer all questions.
3. Unless stated otherwise, if an answer is given as a decimal, it should be rounded to **four** significant figures.
4. Write your answers in the Answer Booklet provided.
5. Show all relevant steps to obtain maximum marks.

Question 1

(a) Prove the identity $1-\cot^2\theta=\dfrac{\cos 2\theta}{\cos^2\theta-1}$. [4 marks]

(b) Without using a calculator, find the exact values of

(i) $\csc\left(\tan^{-1}\dfrac{15}{8}\right)$

(ii) $\cos\left(\tan^{-1}\dfrac{15}{8}\right)$ [6 marks]

(c) Solve $\sqrt{2}\cos\theta=\sin^2\theta+\cos^2\theta$ for $0\le\theta<4\pi$. [6 marks]

(d) Solve the triangle in Figure 1 for the unknown internal angles and side. The figure is not drawn to scale. [9 marks]

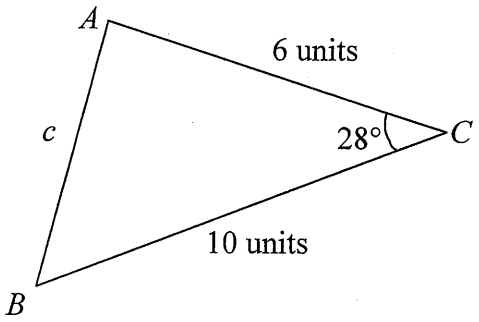

Figure 1

Question 2

(a) Let $a=-5+3i$ and $b=-9-2i$. Find $\dfrac{a\bar{b}}{b}$ in standard form. [4 marks]

(b) Convert $21-23i$ to polar form. Express the argument in the interval $[0,2\pi)$. [4 marks]

(c) If $\arg(5+2i)$ is a where $0\le a<2\pi$, find in terms of a the argument of

(i) $-5-2i$

(ii) $-5+2i$

(iii) $5-2i$

(iv) $10+4i$ [4 marks]

(d) Find p if $\underset{\sim}{a}=p\underset{\sim}{i}-3\underset{\sim}{j}+10\underset{\sim}{k}$ is orthogonal to $\underset{\sim}{b}=p\underset{\sim}{i}+p\underset{\sim}{j}-\underset{\sim}{k}$. [4 marks]

(e) Find $|\underset{\sim}{w}\times\underset{\sim}{v}|$ if $\underset{\sim}{v}=\underset{\sim}{i}+11\underset{\sim}{j}+21\underset{\sim}{k}$ and $\underset{\sim}{w}=2\underset{\sim}{i}+12\underset{\sim}{j}+22\underset{\sim}{k}$. [4 marks]

(f) Determine if $\overrightarrow{PQ}$ is parallel to $\overrightarrow{QR}$ where $P(10,-10,10)$, $Q(5,-2,7)$ and $R(1,5,-5)$. [5 marks]

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Question 3

(a) Find the equation of the line that is perpendicular to $y = -\pi$ and contains the point (3, 0). [1 mark]

(b) Given a line L that passes through points C (5, 2) and D (0, 4),
(i) find its equation in standard form, and [4 marks]
(ii) determine if the point $\left(1, \frac{18}{5}\right)$ is on L. [2 marks]

(c) Find the centre and radius of the circle $x^2 + y^2 - 2x + 4y = 0$. Identify also its x-intercepts. [9 marks]

(d) The equation of an ellipse is $\frac{(x-1)^2}{9} + \frac{(y+2)^2}{4} = 1$. Find the coordinates of the centre, foci and vertices of the ellipse. Then, find the sum of the distances of the ellipse from both foci. [9 marks]

Question 4

(a) Find $\begin{bmatrix} -1 & 2 & 3 & -3 \\ 2 & 6 & 2 & 2 \\ -3 & -4 & -5 & -1 \end{bmatrix} \begin{bmatrix} -2 & 2 \\ 2 & -2 \\ 3 & 4 \\ -4 & -3 \end{bmatrix}$. [3 marks]

(b) A theatre has 500 seats, divided into orchestra, main, and balcony seating. Orchestra seats sell for RM 100, main seats for RM 70, and balcony seats for RM 50. If all the seats are sold, the gross revenue to the theatre is RM 34,200. If one fifth of the orchestra seats, one third of the main seats, and half of the balcony seats are sold, the gross revenue is RM 11,650.
(i) Set up 3 simultaneous equations to find the number of each seating. [3 marks]
(ii) Using the inverse of a matrix, find the number of each seating. [13 marks]

(c) Show that $(k+h)A = kA + hA$ if h and k are real numbers, and $A = \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix}$. [6 marks]

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APPENDIX

$$\sin^2\theta+\cos^2\theta=1$$
$$\tan^2\theta+1=\sec^2\theta$$
$$1+\cot^2\theta=\csc^2\theta$$

$$\cos(A+B)=\cos A\cos B-\sin A\sin B$$
$$\cos(A-B)=\cos A\cos B+\sin A\sin B$$
$$\sin(A+B)=\sin A\cos B+\cos A\sin B$$
$$\sin(A-B)=\sin A\cos B-\cos A\sin B$$
$$\tan(A+B)=\frac{\tan A+\tan B}{1-\tan A\tan B}$$
$$\tan(A-B)=\frac{\tan A-\tan B}{1+\tan A\tan B}$$

$$\sin 2A=2\sin A\cos A$$
$$\cos 2A=\cos^2 A-\sin^2 A$$
$$=2\cos^2 A-1$$
$$=1-2\sin^2 A$$
$$\tan 2A=\frac{2\tan A}{1-\tan^2 A}$$

$$\sin^2 A=\frac{1-\cos 2A}{2}$$
$$\cos^2 A=\frac{1+\cos 2A}{2}$$
$$\tan^2 A=\frac{1-\cos 2A}{1+\cos 2A}$$
$$\tan A=\frac{\sin 2A}{1+\cos 2A}=\frac{1-\cos 2A}{\sin 2A}$$

$$\sin A\cos B=\frac{1}{2}[\sin(A-B)+\sin(A+B)]$$
$$\cos A\cos B=\frac{1}{2}[\cos(A-B)+\cos(A+B)]$$
$$\sin A\sin B=\frac{1}{2}[\cos(A-B)-\cos(A+B)]$$

$$\sin A+\sin B=2\sin\frac{A+B}{2}\cos\frac{A-B}{2}$$
$$\sin A-\sin B=2\cos\frac{A+B}{2}\sin\frac{A-B}{2}$$
$$\cos A+\cos B=2\cos\frac{A+B}{2}\cos\frac{A-B}{2}$$
$$\cos A-\cos B=-2\sin\frac{A+B}{2}\sin\frac{A-B}{2}$$

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